

REMARKS

Review and reconsideration of the Office Action of February 20, 2003, is respectfully requested in view of the above amendment and the following remarks.

Claims 1-12 are rejected.

Claims 1-12 are pending.

In the Specification

The specification has been amended to correct obvious typographical errors. For the amendment to page 8, line 10, support for this typographical error can be found on page 5-6, lines 32-1. For the amendment to page 11, the paragraph starting on line 30, the chemical formulas were more properly written with subscripts.

Care has been taken to ensure that no new matter is introduced by this amendment.

In the Claims

35 U.S.C. § 103(a)

Examiner has rejected claims 1-12 as being unpatentable over Danly, Sr. in view of Ecer, Sato et al. and Takahashi et al.

According to Examiner, it would have been obvious to combine the bushing of Danly, Sr. with the "hardfacing" material discussed in the other three patents.

Applicants respectfully traverse. In the prior state of the art, a common problem was the implementation of proper maintenance

procedures. Stamping plant managers had difficulty getting press operators to regularly lubricate the stamping tools. One particularly difficult policing situation would arise in large stamping plants running on a three-shift basis. If lubrication was not applied, the machinery would seize and the rapid wear on the bearings would cause their frequent replacement.

The inventor in the Danly, Sr. patent attempted to solve the above-described problems by decreasing the amount of lubrication required. Unfortunately, the invention did not completely eliminate the need for lubrication.

In another attempt to solve the problems in the state of the art, Ecer taught that a hardfacing material would improve the wear resistance of a material. Again, though, this invention did not completely eliminate the need for lubrication. Additionally, the process described in Ecer cannot be easily adapted to non-planar surfaces, and especially cannot be used in particularly deep recesses such as internal bores of bushings. Further, the environment of use indicated in the Ecer patent, such as crankshaft bearings and "downhole" prospecting for oil, indicates the presence of external liquid lubricants.

Considering the above-described state of the art, the Applicants determined to solve these problems and to provide a high performance bushing which required **no lubrication**.

Applicants distinguish their present invention from Ecer by the mere fact that Ecer creates the possibility for the use of lubrication. The present application is unique and novel because it completely eliminates the requirement for lubrication. This is a great advancement over the prior art, which required at least periodic lubrication.

The present invention is not properly subject to an obviousness rejection because the present invention qualifies under the secondary considerations outlined in Graham v. John Deere Co., 383 US 1, 148 USPQ 459 (1966).

First of all, the present invention has **replaced the prior art devices in the industry**. For example, major companies have standardized the present invention on all discs and plastic moulds because it outperforms all other devices.

Additionally, the discovery of improved results realized by using the above-listed particles was made only after **extensive experimentation** into possible techniques for improving bronze-coated bushings, including investigation of metered lubricant injection, various lubricant retaining polymers, graphite plug designs, various possible lubricant/anti-friction particles. Further, working with particles to modify a bronze bearing surface is more complex in practice than it might appear, since

(1) hard particles might wear away or damage the surface being supported,

(2) hard particles might accumulate between the bearing surface and the supported surface, and thereby actually increase wear,

(3) particles may be incompatible with bronze, i.e., may interfere with sintering of bronze or may interfere with the formation of good bonding between the bronze and the steel body,

(4) the differences in thermal coefficient of expansion can have adverse effects,

(5) particles must not interfere with the superior heat conducting properties of bronze,

(6) thousands of possible particles are known, having the most diverse alloy compositions and properties, and finding an optimal particle is difficult,

(7) the amount of particle to be mixed with the bronze must be experimentally verified,

(8) various ratios of copper and tin for optimizing the bronze, as well as possible additional and/or alternative matrix alloys, such as brazing metals such as silver, copper, bronze-aluminum alloy, etc., are candidates for investigation,

(9) a sintered product must be able to be machined without separation of the anti-friction layer from the base material, and finally,

(10) testing involves not only forming and sintering but also extensive testing of wear resistance, which is time consuming and expensive.

Due to the complexity of determining the appropriate combination of hardfacing and lubricating particles, Applicants believe that the mere fact that one prior art reference uses hardfacing materials and another prior art reference uses lubricating particles does not render the unique combination of materials used in the present invention and in their unique concentrations obvious.

Finally, Applicants point out that the extensive testing and experiments yielded an **unexpected result**. Surprisingly, it was discovered that too much embedded lubricant can be as harmful as too little. For example, at a 5% concentration, the dispersed lubrication particles were disconnected in the bronze microstructure, providing lubricity without embrittling the bronze.

At a 10% concentration, the particles remained disconnected but

provided better lubrication due to their greater numbers. At the percolation limit around 15%, however, performance degraded as the particles became connected to the bronze and damaged its mechanical properties. This result could not be predicted. The above-cited properties are claimed in claim 1, generally, and claim 3, more specifically.

This product has already been implemented in the field, and Applicants are prepared to offer further substantiation for the statements contained herein in a § 132 Declaration, if necessary.

**35 U.S.C. § 112**

Examiner rejected claims 1-12 under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention:

- in claims 1-7 and 10-12, the term "hardfacing composition" is indefinite;
- in claims 1, 2 and 4-12, the term "percolation limit" is indefinite; and
- claim 7 is indefinite because the recitation "= 50 wt.% cobalt and = 25 wt.% molybdenum" is unclear.

**1. Regarding "Hardfacing Composition"**

Applicants respectfully traverse this rejection. Applicants respectfully disagree with Examiner that the term "hardfacing

composition" is indefinite. The term "hardfacing composition" is both well defined in the specification and is well known to those skilled in the art.

The term "hardfacing composition" is used in the written description (e.g. at page 4) to describe either metal carbide based compositions or intermetallic hardfacing alloys. Those skilled in the art are most familiar with hardfacing compositions when referred to by their proprietary names, such as STELLITE alloys, HAYNES alloys, DELCROME alloys and TRIBALLOY alloys. STELLITE alloys are examples of carbide based hardfacing alloys, whereas TRIBALLOY alloys are examples of intermetallic hardfacing alloys high in molybdenum and cobalt. Additionally, the terms are used frequently in the prior art cited by Examiner, Ecer et al. (column 4, lines 60-66). Finally, the three combinations of hardfacing compositions is both claimed and described in claims 7-9, thus further defining the meaning of the words "hardfacing composition."

Therefore, Applicants submit that the phrase "hardfacing composition" is not indefinite, and respectfully request that the rejection be removed.

## **2. Regarding "Percolation Limit"**

Applicants respectfully traverse this rejection. Applicants respectfully disagree that the term "percolation limit" is indefinite. The phrase "percolation limit" is well known to those skilled in the art. For example, the phrase "percolation limit" was allowed in claims 1, 4, 13, 16, 22, 25 and 28 of U.S. Patent No. 6,518,754 (issued February 11, 2003). This suggests that another Examiner did not find the term indefinite.

Further, the definition of "percolation limit" can also be

found in many online websites. For example, from the University of Berkely, Professor Junqiao Wu's Paper on "Introduction to Percolation Theory" describes, in detail, the theory behind the phrase "percolation limit." (available at <http://garnet.berkeley.edu/~jqwu/paper1/paper1.html> (last modified May 19, 2003)). Additionally, as Professor Wu's paper describes with mathematical detail, the phrase "percolation limit" is extremely quantifiable and definite.

Therefore, Applicants submit that the phrase "percolation limit" is not indefinite, and respectfully request that the rejection be removed.

### **3. Regarding Claim 7**

Applicants have amended Claim 7 to overcome the formality objection. The "=" in claim 7 have been deleted such that the phrase presently reads "50 wt.% cobalt and 25 wt.% molybdenum."

### **4. Regarding Obvious Typographical Errors**

Claims 1 and 3 have been amended to recite an obvious typographical error. These changes are supported by the specification and do not introduce new subject matter. The amendment ensures that claim 1 is the broadest claim in the application, finding support for the lower limit range of 2% on page 8, line 13. Support for the amendment to claim 3 can be found on page 13, lines 28-35.

The Examiner considers the prior art made of record and not relied upon pertinent to Applicant's disclosure.

U.S. APPLICATION 09/783,242  
AMENDMENT A

Attorney Docket No.: 3654.006

Favorable consideration and early issuance of the Notice of Allowance are respectfully requested. Should further issues remain prior to allowance, the Examiner is respectfully requested to contact the undersigned at the indicated telephone number.

Respectfully submitted,

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